

Title: A Parade of Patterns

Brief Overview:

This three day lesson series is an in depth unit that has students analyze numeric and non-numeric repeating patterns and growing patterns. During this unit, students will find the core of repeating patterns and recognize the different elements given in repeating patterns. Students will then represent growing patterns using different representations such as pictures. Students will also need to determine the next level of a growing pattern and determine the number of elements in the next level. Let's march to the beat of patterns and celebrate!!

NCTM Content Standard/National Science Education Standard:

Understand patterns and relations

- Describe, extend, and make generalizations about geometric and numeric patterns
- Represent and analyze patterns using words and tables

Grade/Level:

Grades 2-3

Duration/Length:

Three to four class sessions, approximately 60 minutes per session

Student Outcomes:

Students will:

- Identify, describe, extend, and create non-numeric growing or repeating patterns.
- Represent and analyze growing patterns using symbols, shapes, designs, or pictures.
- Represent and analyze repeating patterns using symbols, shapes, designs, or pictures.

Materials and Resources:

Day 1

- Patterns on Parade by Joan Freese
- Student Resource 1, Exploration Day 1
- Student Resource 2, Explanation Day 1
- Student Resource 3, Assessment Day 1
- Teacher Resource 1, Pattern Block Template (optional)
- Teacher Resource 2, Exploration Answer Key Day 1
- Teacher Resource 3, Application Answer Key Day 1
- Blackboard/Overhead Projector
- Chalk/Overhead Markers

- Pattern blocks

Day 2

- Student Resource 4, Engagement Day 2
- Student Resource 5, Application Day 2
- Student Resource 6, Assessment Day 2
- Teacher Resource 1, Pattern Block Template (optional)
- Teacher Resource 4, Application Answer Key Day 2
- Teacher Resource 9, Assessment Day 2
- Pattern Blocks
- Blackboard/Overhead Projector

Day 3

- Student Resource 7, Engagement Day 3
- Student Resource 8, Application Day 3
- Student Resource 9, Assessment Day 3
- Student Resource 10, Summative Assessment
- Teacher Resource 5, Engagement Answer Key Day 3
- Teacher Resource 6, Level Template
- Teacher Resource 7, Application Answer Key Day 3
- Teacher Resource 8, Summative Assessment Answer Key
- Cups to Hold Growing Pattern Manipulatives
- Optional Materials to Create Growing Patterns:
 - Buttons, stickers, macaroni, beans, teddy-bear counters, cubes, paper clips, toothpicks, or popsicle sticks
 - Connecting cubes, legos, or stacking blocks
 - Teacher Resource 9, MATH TALK (optional) this sheet can be used to record new math vocabulary students learn throughout the lesson.

Development/Procedures:

Day 1

- Pre-assessment
In order to evaluate students' prior knowledge about repeating patterns and growing patterns, students will complete a pre-assessment activity using pattern blocks. Distribute pattern blocks or cut-outs of Teacher Resource 1, Pattern Blocks Template, to each child and ask them to represent an AB pattern with the blocks (eg: triangle, square, triangle, square, triangle, square). Circulate around the classroom and take anecdotal notes about student work. Then, ask students to represent a growing pattern with pattern blocks (eg: square, square triangle, square triangle triangle). Walk around the classroom and take anecdotal notes on their work.
- Engagement
Ask the students if they can identify any patterns within the classroom. Initiate a brief discussion with students about patterns that they have found. Ask them to

describe why they think their findings constitute patterns. Discuss what they believe makes a pattern.

To introduce the skill of repeating patterns, tell students that they will be listening to a story called Patterns on Parade by Joan Freese. As they listen to the story, they should look for any patterns that appear in the illustrations. Stop and identify the pattern when students spot a pattern in the story. Have students turn and talk with a partner about why they think that makes a pattern.

- Exploration
Distribute Student Resource 1, Exploration Day 1. Explain that students will illustrate the next balloons in the repeating patterns. They may use colors to represent each balloon in the pattern, or they can label the balloons with the first letter of the color (eg: p=pink, y=yellow, r=red, g=green, b=blue). Circulate throughout the classroom and monitor student progress.
- Explanation
Make a transparency of Student Resource 1 and have student volunteers share their answers of the Exploration.

Explain that **repeating patterns** are sequences of items that repeat, and the **core** is the part of the repeating pattern that repeats at least 3 times. For example, if the pattern of balloons is red, red, blue, yellow, red, red, blue, yellow, red, red, blue, yellow, the core of the pattern is red, red, blue, yellow. An **element** is one term within a repeating pattern. For example, in our balloon pattern, yellow represents one element.

Write the pattern r,r,b,y,r,r,b,y,r,r,b,y on the blackboard or overhead projector or create the pattern AABC using pattern blocks. Demonstrate how to put a box around the core. Select a student from the class and ask them to identify the core in the pattern again by drawing a box around it. Instruct that student to pick another volunteer to box the core again. Ask students to describe how many times the core of the pattern has been repeated. Explain that the core must repeat at least three times in the repeating pattern in order for it to create a pattern. Explain that the core should repeat at least three times, and that the core can be thought of as a “stamp” that is repeatedly used to create a pattern.

Tell students that the core of the pattern can also be named by the letters “AABC”. Have students discuss with a partner why the pattern red, red, blue, yellow could be labeled “AABC”. When students have had time to discuss, talk as a group about how letters can correspond with objects within a pattern. Ask students to explain how they know when to include a new letter in the pattern. Explain that each letter corresponds with one object from the pattern. Therefore, when a new object in the pattern appears, as in this case a different color, a new letter is used. Similarly, explain that numbers, such as “1123” can also be used to describe this repeating pattern.

Write the pattern red, yellow, red, yellow, red, yellow, _____, _____ on the board. Distribute Student Resource 2 to students and review the directions together. Tell students that they will be working on the first problem, in which they will continue the pattern, draw a box around the core, and label the pattern underneath using letters or numbers. Give students a few minutes to work and circulate throughout the classroom to monitor their progress. When most students are finished, review the pattern additions (red, yellow), the box around the core (red, yellow), and another representation of the pattern (A,B, or 1,2, etc.).

Write the pattern blue, red, red, blue, red, red, blue, red, red, _____, _____, _____ on the board. Tell students to look at the new pattern, continue the pattern, draw a box around the core, and label the pattern underneath using letters or numbers. When most students are finished, review the pattern additions (blue, red, red), the core (blue, red, red) and another representation (A,B,B, or 1,2,2, etc.).

○ Application

Explain that students will now have the opportunity to create their own repeating patterns using pattern blocks. Review the important features of repeating patterns together, using the following questions to facilitate the discussion:

- How can you tell if a pattern is repeating?
- How would you determine the core of a repeating pattern?
- How many times does the core need to be repeated in order to make it a repeating pattern?
- Why do you think the core should be repeated at least three times to demonstrate that it is a repeating pattern?

Give students time to generate their repeating patterns on their desks. Circulate to ensure that students are creating repeating patterns. Tell students to share their repeating pattern with a partner, and ask the partner to determine the core and name the pattern. If any students need to adjust or modify their patterns based on their partner's feedback, they can do so at this time.

Tell students that they will be participating in a parade around the classroom to observe many examples of repeating patterns. Have the students march around the classroom and look at other students' patterns.

Say: "Parade Halt!" and ask all students to freeze where they are. Make sure that all students are observing another student's work rather than their own. Instruct students to sit down at the nearest desk and take a look at that student's pattern. Tell them that they will be adding one repetition of the core to that student's work using pattern blocks. Give students time to continue their classmate's pattern, and have them share with a partner.

If time permits, continue the Pattern Parade, allowing students to march around

the classroom. Say: “Parade Halt” again when it’s time for students to continue another pattern.

- Differentiation
 - Reteach
Model how to identify the core in a pattern with a smaller core, such as AB or ABC. If it is appropriate for the entire class, use body movement patterns such as clapping, slapping knees, snapping, and tapping shoulders as a way to practice identifying the core of the repeating pattern.
 - Enrich
Challenge students by giving them a set number of pattern blocks. Have them create as many different repeating patterns as possible. For example, give students 9 squares and 8 triangles. Instruct them to name the repeating patterns in at least two ways.

Give them a pattern like 12323 and have them represent the repeating pattern using pattern blocks.
- Assessment
Distribute Student Resource 3. Review the directions together and give students time to complete it independently.

Day 2

- Engagement
Tell students that today they will be playing an exciting game called Parade Pattern Pairs. In this game, they will be matching picture patterns of the core of repeating patterns with the numeric or letter representations of the cores to which they correspond. For example, AAAB matches the first balloon pattern (refer to Student Resource 4A-B to find this example).

Distribute the cards and instruct students to separate the cards into two piles: picture patterns and picture names (ABC, 123, etc). Once the piles are sorted, instruct students to lay the cards face down on the desk, making sure to keep the two piles separate. They will take turns with a partner selecting one picture pattern and one picture name card to determine if a match was found. Cards should be shown to both students, and cards that are not a match should be returned to the same location on the desk. The winner in each pair will find the most Parade Pattern Pairs.
- Exploration
Place pattern blocks on the overhead projector in the ABCB pattern. In one of the core repetitions, leave one pattern block out (eg: ABCB, ABC_, ABCB or ABCB, _BCB, ABCB). Ask students to complete the pattern using pattern blocks at their desks. Circulate around the classroom and observe students exploring. Take note of which students are able to identify the missing element, and which students are

not.

- Explanation

When most students are finished, discuss how they determined the missing element, using the following questions to guide the discussion:

- What was the missing element in the repeating pattern?
- How did you determine what was missing?
- Why is identifying the core so helpful in finding the missing element?
- If the pattern was not repeated, would you be able to determine if there was a missing element? How do you know?

Remind students that **repeating patterns** are sequences of items that repeat, and the **core** is the part of the repeating pattern that repeats at least 3 times. When a repeating pattern has a missing element, that means that one element of the core is not present in at least one repetition of the pattern.

Demonstrate by placing an ABC, A_C, ABC pattern on the overhead projector. Explain to students that the first step in determining the missing element is to identify the core. Discuss how to identify the core, and label the pattern ABC. Show students that the B element in the pattern is missing, which therefore means that the corresponding pattern block would be _____ (answers will vary depending on the pattern selected).

Place an AABB repeating pattern on the overhead projector using pattern blocks. Leave two elements out of the pattern, such as A_BB, AABB, __ABB or __ABB, AAB__, AABB. Ask students to identify and label the core, as well as determine which elements are missing.

Review the answers together as a class (answers will vary depending on the pattern selected). Use the pattern previously selected, and select two new elements to remove from the pattern. Ask students to think about how these new missing elements will change the pattern. Have them identify which elements are missing, and how those missing elements differed from the last set of missing elements.

- Application

Distribute Student Resource 5. Review the directions together, explaining to students that they will be using pictures from the Pattern Picture Bank to add the missing element to the patterns. Explain that they will also be creating their own repeating patterns with missing elements using the pictures. Tell students that after they complete questions 1 and 2, they can use the remaining pictures from the Picture Bank to create their own repeating pattern with a missing element on the back.

Give students time to work independently. Circulate around the classroom and observe student progress.

Use a transparency of Teacher Resource 4 to facilitate a discussion of the answers. Have the students turn and talk with their partner to share the missing element in the repeating pattern that they created. Ask students to label their partner's pattern and identify the missing element. Select a few students to share their partner's pattern with the class. Discuss how to determine the missing element, and ask students to think about how the patterns could be identified.

- Differentiation

- Reteach

- Use pattern blocks and have students separate the core into groups for each repetition (eg: ABA ABA ABA with space between each core). Once students see the core isolated, take away one block from one of the cores and ask them to identify what is missing by looking at the other completed cores. Repeating this procedure as needed, eventually having students identify the missing element within the entire repeated pattern.

- Enrich

- Ask students to use pictures or pattern blocks to create ABBC, ABCB, and AABA patterns with missing features.

- Assessment

Distribute Student Resource 6. Have students respond to the following journal prompt: "Suppose a parade is coming through your neighborhood. The repeating pattern of animals follows the 1233 pattern. What is an example of a repeating pattern of animals that could be in the parade? How would the pattern change if the animals represented by the "2" are no longer participating in the parade?"

Day 3

- Engagement

The students that today they will be playing an exciting game called "Match the Munchies." In this game, they will be matching picture cores with the numeric and letter cores to which they correspond. For example, A, B, A matches 1, 2, 1, and popcorn, lollipop, popcorn (refer to Student Resource 7 to find this example). Cut and distribute the cards from Student Resource 7. Instruct students to lay the cards face up on their desks. Tell students that they should look for the same core in pictures, letters, and numbers. Three cards should match each other, and there should be three total sets of matches.

Give students time to find the "Munchie Matches" and circulate around the classroom to monitor student work. Utilize Teacher Resource 5 to check the matches.

- Exploration

Distribute one cup full of manipulatives to each set of partners (see Day 3

Materials for a list of recommended materials). Tell students that they will have the opportunity to create their own growing pattern using the manipulatives in the cups. If students are unfamiliar with growing patterns, and are not sure where to begin, refer to the **Explanation** and share the features of growing patterns with students.

Select some students to share their growing patterns with the class. Ask them to explain why their pattern represents a growing pattern, and how many elements are added in each step.

- **Explanation**

Tell the students that today they will be learning about growing patterns. Have students make predictions about what growing patterns are, and ask them to identify any growing patterns in the classroom that they see. Discuss why those patterns could be growing patterns.

Explain to students that today they will be creating “People Patterns” by making growing patterns with classmates. Tell them that students will be selected to come to the front of the classroom and link arms to represent different levels within the growing pattern. The rest of the students will try to identify the pattern by determining how many are being added in each level. Use the cards on Teacher Resource 6A-C, and select one student to hold the “Level 1” card. Select two students to stand near “Level 1” and hold the “Level 2” card. Repeat this process for levels 3 and 4, selecting three students for “Level 3” and four students for “Level 4”. Ask remaining students if they can identify the rule for the growing pattern (One is being added each level).

Have the selected students sit down, and pick different students to represent the pattern 2, 4, 6. Discuss the rule for this growing pattern, and ask students to think about the difference between the 1, 2, 3 pattern and the 2, 4, 6 pattern. (Two is being added each level).

Explain that a **growing pattern** involves a progression from one step to the next. Each step is related to the previous step as defined by the pattern. For example, if a float from a parade has a growing pattern of flowers, one petal could be added to each step of the growing pattern. A change from step to step can be made by adding on to or expanding the previous step. In this example, the change from step to step is adding one petal to each flower.

Tell students that when they think about growing patterns, the pattern can be discussed in two important ways. Share with students that patterns can be discussed in terms of appearance. In thinking about appearance, they should think “how will the next step look?” In the example of the growing flowers, each step will look more and more full, since another flower petal is being added each time. Another way to discuss growing patterns is numerically. Numerical descriptions refer to “how many will be in the next step?” If our flower petal starts with one

petal, the next step will have two petals, the third step will have three petals, etc.

- Application

Distribute Student Resource 8A-B. Review the directions for questions 1-3 with students and give them time to complete the work independently. Introduce the BCR on Student Resource 8B. Tell students that today they will be showing the next level of a growing pattern, and identifying how much the pattern is growing by in each level.

Write “growing patterns” on the board. Ask students to share information about what they know about growing patterns. List student responses on the board, putting stars by any important vocabulary terms (eg: **level**, **growing pattern**, etc). Tell students that they will use this information to explain how they determined the next level in the growing pattern.

Let students work with a partner to find the next level in the growing pattern. Then, have them turn and talk with a partner to discuss how they could explain their mathematical thinking. Ask students to share the ideas discussed with their partner, and write the Brief Constructed Response together, using Teacher Resource 7A-B, Answer Key as a guide.

- Differentiation

- Reteach

Distribute connecting cubes, Legos, or stacking cubes to students. Demonstrate growing patterns using the manipulatives to show that the element gets larger in each level. Ask students to identify how much is being added each time.

- Enrich

Challenge students to create their own growing patterns using the Pattern Generator feature at the below website:

http://www.shodor.org/interactivate/activities/PatternGenerator/?version=1.6.0_13&browser=MSIE&vendor=Sun_Microsystems_Inc.

- Assessment

Distribute Student Resource 9. Review the directions together and give students time to complete it independently.

Summative Assessment:

Upon completion of this unit, use Student Resource 10A-B as an assessment of skills taught. There are 3 multiple choice questions and one open-ended response. The first question requires students to find the missing elements in a repeating pattern. Question two requires students to recognize picture to letter and/or number patterns. Question three requires students to complete a growing pattern by drawing a picture and recording

information into a chart. Question four is an open-ended response similar to the one completed the previous day.

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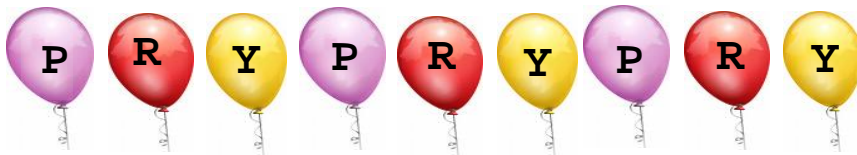
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Let's Go To a Parade!!

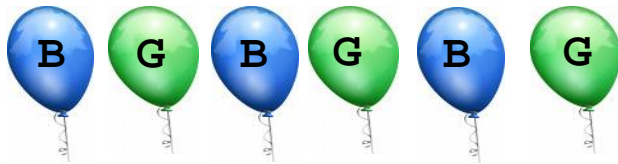
Draw what comes next...

1



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2



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Let's Go To a Parade!!

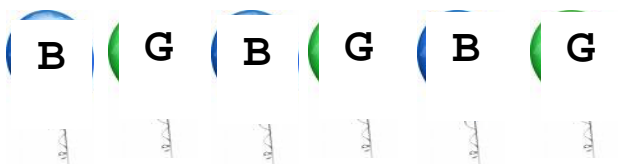
Draw what comes next...

1



--	--	--

2



--	--	--	--



Parade of Patterns

Finish the pattern.

Place a box around the **core**.

Label the pattern with letters or numbers.

1. Red, Yellow, Red, Yellow, Red, Yellow, _____, _____,...

2. Blue, Red, Red, Blue, Red, Red, Blue, Red, Red, _____, _____,...



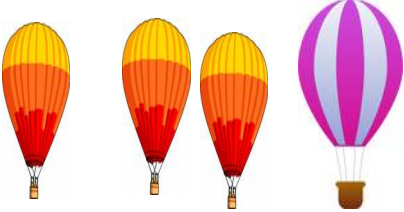



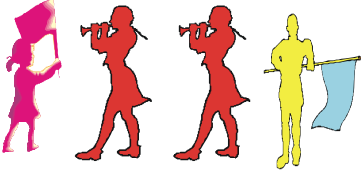




Exit Slip

Design and name your own repeating pattern in the space below.



Exit Slip

Design and name your own repeating pattern in the space below.

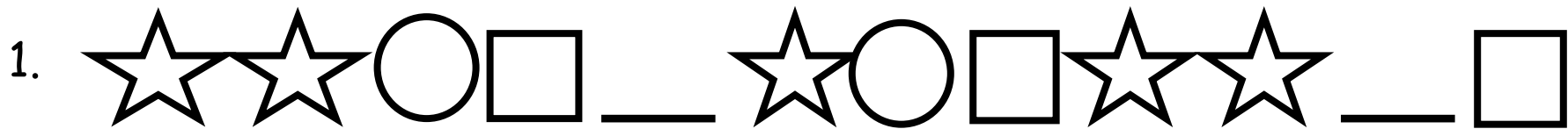
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<p>Parade Pattern Pairs</p> 	<p>Parade Pattern Pairs</p> 	<p>Parade Pattern Pairs</p> 

<p>Parade Pattern Pairs</p> <p>AAAB</p>	<p>Parade Pattern Pairs</p> <p>AB</p>	<p>Parade Pattern Pairs</p> <p>ABABA</p>
<p>Parade Pattern Pairs</p> <p>ABC</p>	<p>Parade Pattern Pairs</p> <p>ABBC</p>	<p>Parade Pattern Pairs</p> <p>AAB</p>
<p>Parade Pattern Pairs</p> <p>ABBC</p>	<p>Parade Pattern Pairs</p> <p>ABB</p>	<p>Parade Pattern Pairs</p> <p>ABCB</p>

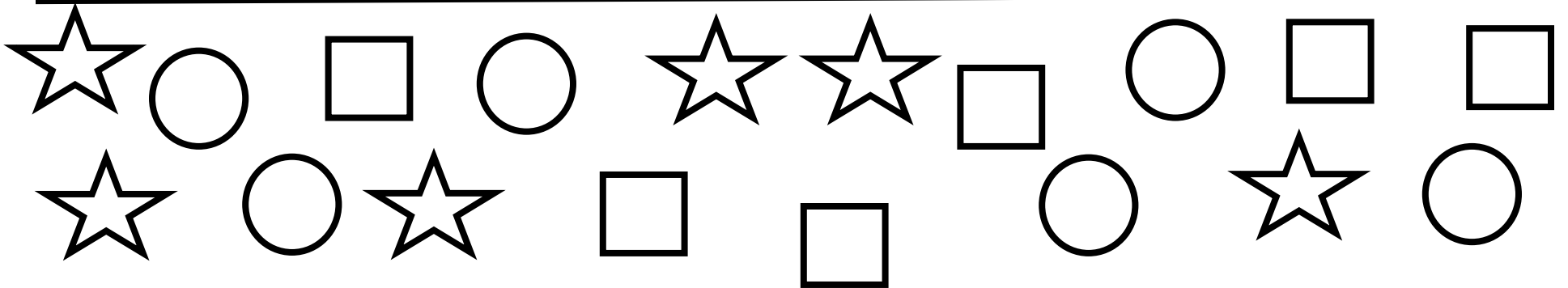
Pattern Pictures

Student Resource 5

Find the missing element in the repeating pattern.



Picture Bank



A Pattern of Parades Journal Prompt














Suppose a parade is coming through your neighborhood. The marching band is followed by a group of animals walking in a line. The repeating pattern of animals follows the 1233 pattern.

- What is an example of a repeating pattern of animals that could be in the parade?

- How would the pattern change if the animals represented by the “2” in the 1233 pattern are no longer participating in the parade?

Match the Munchies

ABA	121	  
ABBC	1223	   
AABC	1123	   

Growing Patterns

1. Draw a picture to show the next level of the growing pattern.



2. Use the growing pattern to complete the table below.



Step 1

Step 2

Step 3

Step 4

Step Number	Step 1	Step 2	Step 3	Step 4
Number of Tiles	1	3		

3. Look at the growing pattern below.



How many stars will be in the fourth step?

A. 10

C. 30

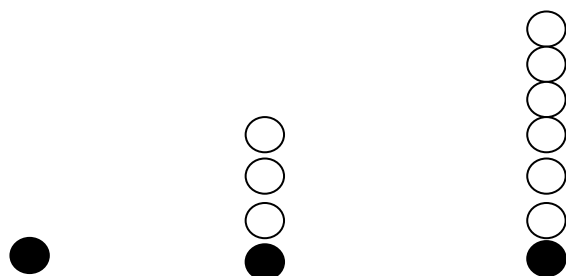
B. 25

D. 16

Brief Constructed Response: Growing Patterns

Draw a picture to show the next level of the growing pattern.

Part A



Part B

Explain why your answer is correct.

Use what you know about growing patterns in your explanation.

Use words and/or numbers in your explanation.



Exit Slip

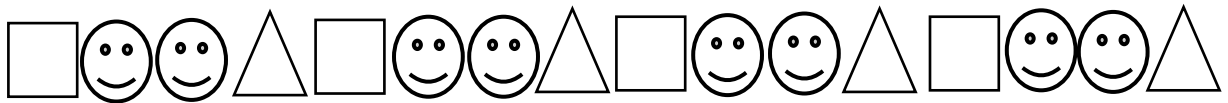
Design and name your own growing pattern in the space below.

Name _____ Date _____

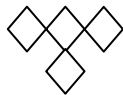
Repeating and Growing Pattern Assessment

Directions: Read each question carefully and circle the letter that matches your answer.

- Find the next two elements in the repeating pattern AABCAABCAABCAA
 - AC
 - AB
 - BC
 - BA
- Choose a pattern that follows the same rule as the repeating pattern below.



- ABCAABCAABCAABCA
 - ABCCABCCABCCABCC
 - AABCAABCAABCAABC
 - ABBCABBCABBCABBC
- Use a growing pattern to complete the table.



Step 1

Step 2

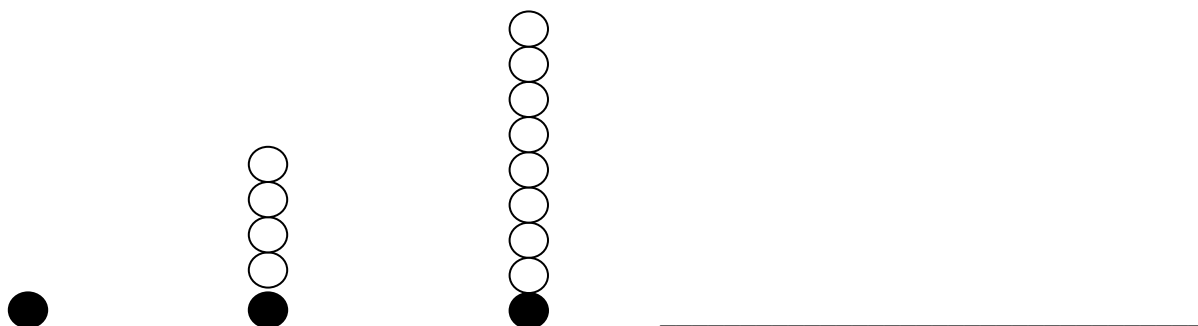
Step 3

Step 4

Step Number	Step 1	Step 2	Step 3	Step 4
Number of Tiles	1	4	7	10

Brief Constructed Response: Growing Patterns

Draw a picture to show the next level of the growing pattern.

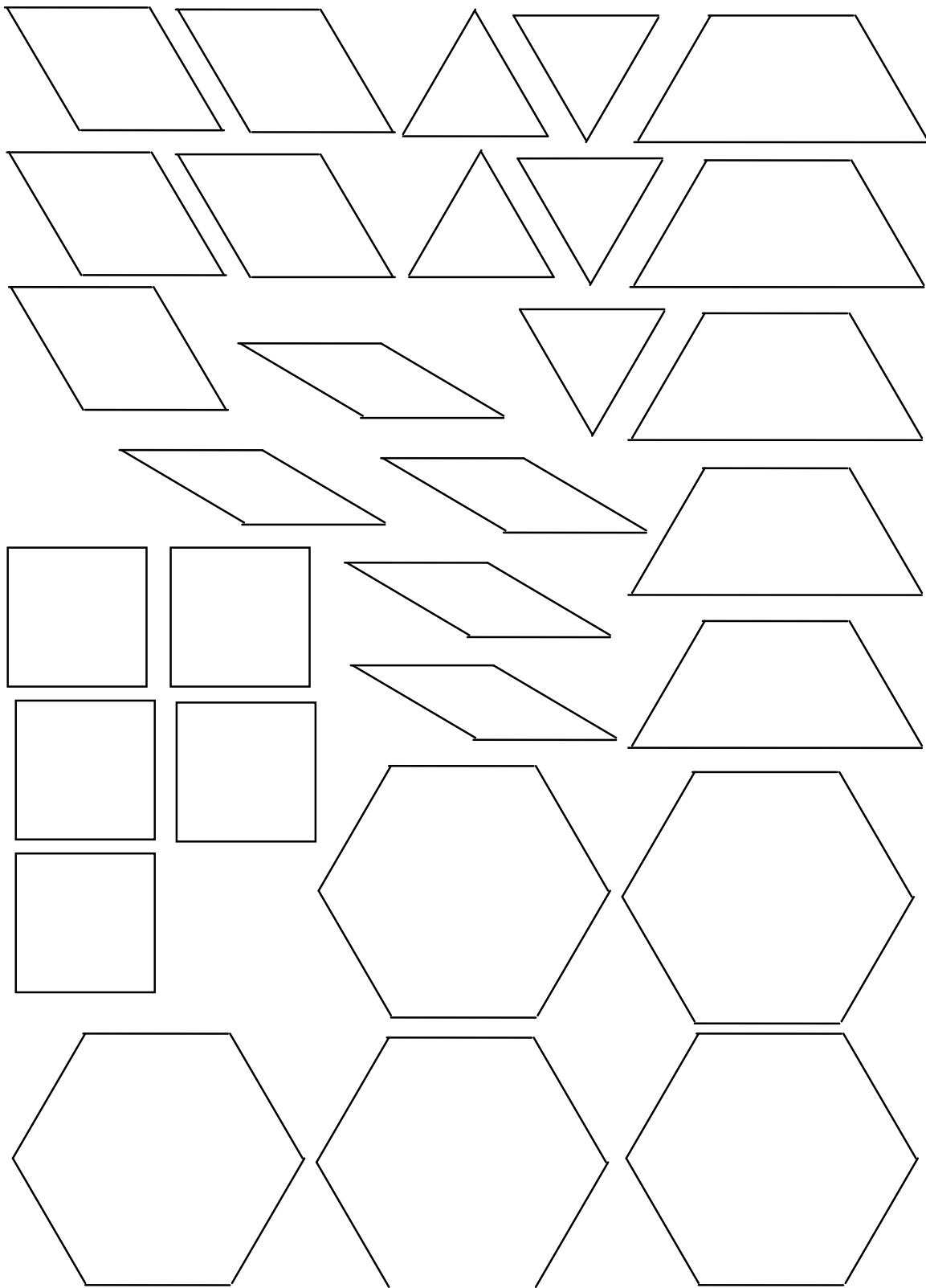
Part A**Part B**

Explain why your answer is correct.

Use what you know about growing patterns in your explanation.

Use words and/or numbers in your explanation.

PATTERN BLOCK TEMPLATE





Draw what comes next...



Let's Go To a Parade!!

Draw what comes next...





Parade of Patterns

Finish the pattern.

Place a box around the **core**.

Label the pattern with letters or numbers.

1. Red, Yellow, Red, Yellow, Red, Yellow, Red, Yellow,...

1 2 1 2 1 2 1 2 ,...

OR

A B A B A B A B ,...

2. Blue, Red, Red, Blue, Red, Red, Blue, Red, Red, Blue, Red,...

1 2 2 1 2 2 1 2 2 1 2 ,...

OR

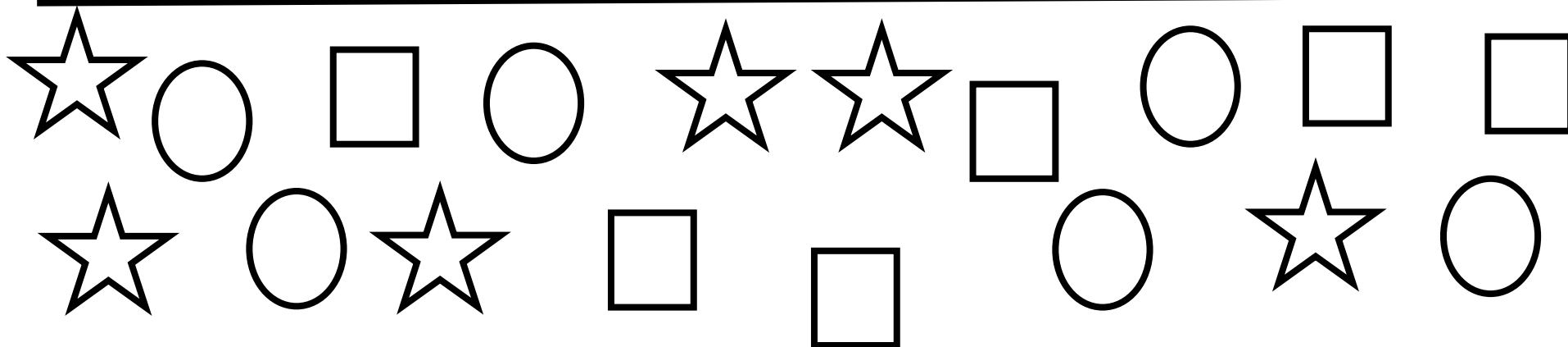
A B B A B B A B B A B ,...

Pattern Pictures

Find the missing element in the repeating pattern.



Picture Bank



Match the Munchies

ABA	121	  
ABBC	1223	   
AABC	1123	   

Level 1

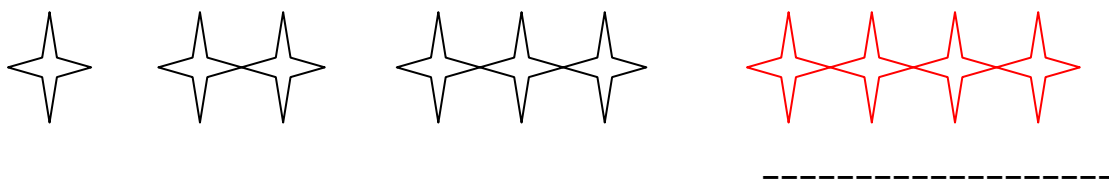
Level 2

Level 3

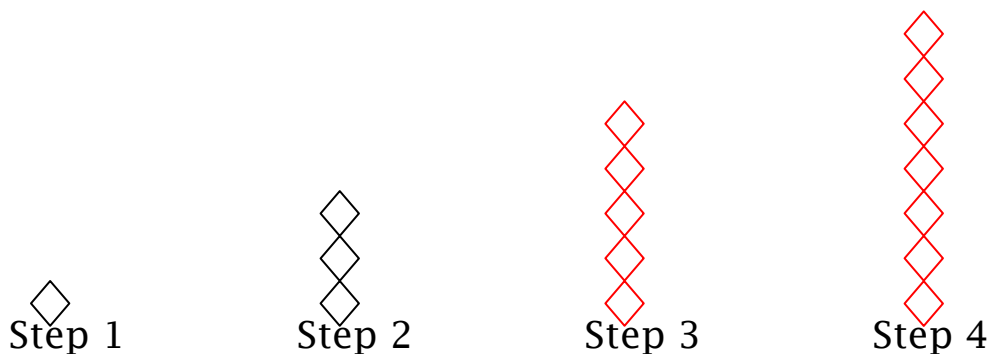
Level 4

Growing Patterns

1. Draw a picture to show the next level of the growing pattern.



2. Use the growing pattern to complete the table below.



Step Number	Step 1	Step 2	Step 3	Step 4
Number of Tiles	1	3	5	7

3. Look at the growing pattern below.



How many stars will be in the fourth step?

A. 10

C. 30

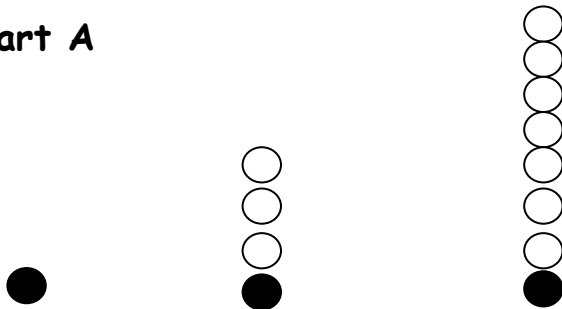
B. 25

D. 16

Brief Constructed Response: Growing Patterns

Draw a picture to show the next level of the growing pattern.

Part A



Part B

Explain why your answer is correct.

Use what you know about growing patterns in your explanation.

Use words and/or numbers in your explanation.

I know that growing patterns involve a movement from one step to the next. Each step is related to the previous step as defined by the pattern. I also know that a change from level to level can be made by adding on to or expanding the previous level. In this growing pattern, each level increases by 3 circles. Since the pattern begins with 1 circle in Level 1 and adds 3 more circles in Level 2 to show 4 circles. The pattern continues in Level 3 with $4+3=7$ circles, and in Level 4 with $7+3=10$ circles. Since the pattern was growing by the same amount, plus 3, in each level, I knew that Level 4 has 10 circles.

Name _____ Date _____

Repeating and Growing Pattern Assessment

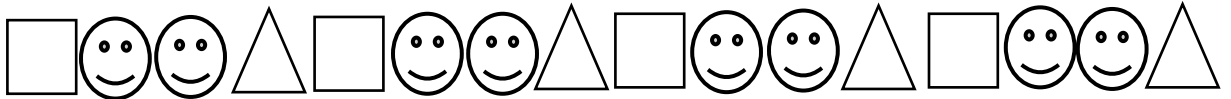
Directions: Read each question carefully and circle the letter that matches your answer.

1. Find the next two elements in the repeating pattern

AABCAABCAABCAA

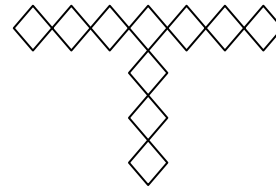
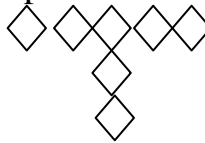
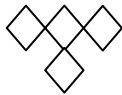
- a. AC
- b. AB
- c. BC
- d. BA

2. Choose a pattern that follows the same rule as the repeating pattern below.



- a. ABCAABCAABCAABCA
- b. ABCCABCCABCCABCC
- c. AABCAABCAABCAABC
- d. ABBCABBCABBCABBC

3. Use a growing pattern to complete the table.



Step 1

Step 2

Step 3

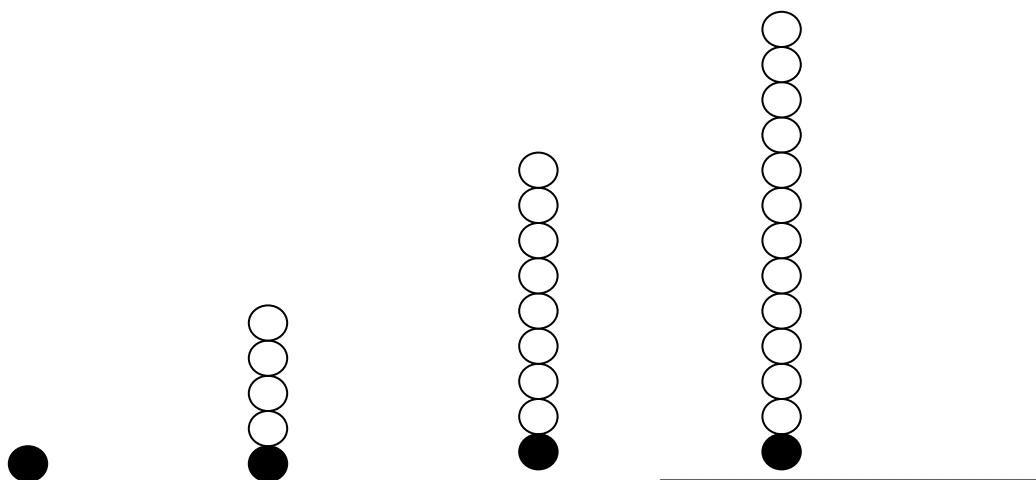
Step 4

Step Number	Step 1	Step 2	Step 3	Step 4
Number of Tiles	1	4	7	10

Brief Constructed Response: Growing Patterns

Draw a picture to show the next level of the growing pattern.

Part A



Part B

Explain why your answer is correct.

Use what you know about growing patterns in your explanation.

Use words and/or numbers in your explanation.

I know that growing patterns involve a movement from one step to the next. Each step is related to the previous step as defined by the pattern. I also know that a change from level to level can be made by adding on to or expanding the previous level. In this growing pattern, each level increased by 4 circles. Each level increases by 4, since the pattern begins with 1 circle in Level 1 and adds 4 more circles in Level 2 to show 5 circles. The pattern continues in Level 3 with $5+4=9$ circles, and in Level 4 with $9+4=13$ circles. Since the pattern was

growing by the same amount, plus 4, in each level, I knew that Level 4 has 13 circles.



Math Talk

A Pattern of Parades Journal Prompt



Suppose a parade is coming through your neighborhood. The marching band is followed by a group of animals walking in a line. The repeating pattern of animals follows the 1233 pattern.

- What is an example of a repeating pattern of animals that could be in the parade?

(Answers will vary). Dog, cat, lizard, lizard, dog, cat, lizard, lizard, dog, cat,

lizard, lizard

-
- How would the pattern change if the animals represented by the “2” in the 1233 pattern are no longer participating in the parade?

The pattern would change if the animals represented by the “2” were no

longer participating, since it would be 1, 3, 3, 1, 3, 3, 1, 3, 3. The parade

would now be dog, lizard, lizard, dog, lizard, lizard, dog, lizard, lizard.